CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE

COLLEGE OF NATURAL AND APPLIED SCIENCES

B.Sc. EXAMINATION RAIN SEMESSTER 2022/2023 SESSION

ICT317: TRANSMISSION PROPAGATION AND ANTENNA THEORY

TIME ALLOWED: $2^{1}/_{2}$ HOURS

INSTRUCTIONS: **ANSWER 4 QUESTIONS ONLY**

1. (a) What is a wave? Mention two similarities and two differences between a mechanical wave and an electromagnetic wave. (5 mks)
   (b) Classify the following waves as either electromagnetic or mechanical: (a) sound (b) radiated heat (c) ultrasound (d) X-rays (e) sunlight (f) radio waves (6 mks)
   (c). Radio waves can be classified as Ultra-High Frequency (UHF), Microwave, Medium Frequency (MF), Low Frequency (LF) and Very High Frequency (VHF). Starting with the **smallest**, arrange these radio waves in the correct order of (i) wavelength (2 mks) (ii) bandwidth (2 mks)

2. (a) What is a transmission line? State any 3 roles it plays in an antenna system. (4 mks)
   (b) Four parameters of a transmission line are the inductance, capacitance, resistance and conductance of every meter of the transmission line. State the two most important parameters of a good transmission line and the formula that determines the characteristic impedance when the effect of the other two parameters is negligible. (4 mks)
   (c) What do you understand by the term Characteristic Impedance of a transmission line? (1 mk). A certain transmission line with a characteristic impedance of 50Ω is connected to an antenna whose resistance is 70Ω. If the total power entering the transmission line is 10 Watts, calculate: (6 mks)
      i. The reflection coefficient
      ii. The Voltage Standing Wave ratio VSWR
      iii. The reflected power

3. Write a short note on
   i. Sky wave (2 mks)
   ii. Ground wave (2 mks)
   The intensity of radio waves reaching a hotel room from an AM radio broadcaster through sky wave is given by $E_1 = 10 \cos(3\pi t + \pi/15)$ while the ground wave signal from the same broadcaster to the same hotel is given by $E_2 = 2 \cos(3\pi t)$. If the field intensity, E is in millivolts mV and the time t is in microseconds μS, calculate the following for E_1 and for E_2
   (a) Wave amplitude A. (2 mks)
   (b) Frequency f. (2 mks)
   (c) Time period T (2 mks)
   (d) Phase angle ϕ in radians and in degrees.(4 mks)
   (e) Between E_1 and E_2 which one has more intensity at the hotel? (1 mk)

4 (a)What is antenna polarization? (2 mks)

A transmitting half-wave dipole antenna is mounted horizontally in the North-South direction (8 mks)

(i)Determine if the antenna is vertically or horizontally polarized.

(ii) Determine the polarization of the receiving antenna for optimum reception.

(iii) Which direction has the highest antenna gain among the following: West, North-East, North-West, South, North?

(iv) Which of the following directions has the lowest antenna gain: North, North-East, East, South-East, South-West, North-West?

5 (b)i. What is the meaning of FM in radio broadcasting? (1 mk)

ii. Faaji FM broadcasts at 106.5. Indicate if the 106.5 is in Hz, KHz, MHz or GHz. (1 mk)

iii. From your answer, calculate the wavelength of their radio signal and the length of a half-wave dipole antenna suitable for receiving the station.(3 mks)

6 (a) i. Describe the construction of a one-quarter wavelength vertical antenna. (5 mks)

ii. State any three reasons why this antenna is commonly used in radio broadcasting. (3 mks)

iii. Federal Radio Corporation, Enugu broadcasts at 612 KHz in the medium wave band using one-quarter wavelength vertical antenna. Calculate the optimum height of their broadcast antenna.(2 mks)

6(b) Define the following in relation to an antenna: (6 mk)

i (ii) Antenna Gain (iii) Radiation Pattern (iv) Directivity

6(c) A major requirement of every satellite antenna is very high directivity. Explain why this requirement is crucial. (2 mks)

END